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ABSTRACT

This document presents data on the relative influence of (1) maternal education, (2) race (or ethnicity) and (3) poverty on elementary students' academic achievement. Study results indicate that maternal education has the greatest effect on achievement. The data base is reported as representative of all U.S. children enrolled in public schools, grades 1 through 6. Home interviews were employed to assess family economic, demographic and social characteristics and the full range of standardized achievement test data was utilized. The effects of the other two factors were controlled for in assessing the influence of each factor. The methodology used to achieve the relative weighting of the factors is described and it is suggested that the data base is superior to that of previous studies. Tables comprising one half of the document present the statistical data. An appendix explains the precedure for approximating standard errors. (Author/BH)

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Out-of-School Determinants of Elementary School Achievement

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1. AN OVERVIEW

Social research, as it relates to educational achievement and its determinants, has profoundly suffered from inadequacies in sampling and measurement. Theoretical arguments have circled around the separate roles of in-school and out-of-school precursers of school learning, but empirical efforts have been hampered by inadequacies of conception and operationalization. From Project Talent, Through the Equality of Educational Opportunity Survey and beyond, measurement -- especially of related school-based characteristics -- has improved, but the assessment of out-of-school factors has remained mixed in the swamps of pupil self-reports or teacher guesses.

The data reported here -- their origins are described below -- represent a major advance in the assessment of out-of-school factors and their relationship to educational achievement. For the first time a data base has been assembled which:

- is representative of all U.S. children enrolled in public schools, grades 1 through 6;
- has fully adequate home-interview-based measurement of family economic, demographic, and social characteristics; and
- has the full range of standardized achievement test data.

In this paper , we have attempted a descriptive exhibition of some of the main features of these data. Accurate social benchmarks are difficult to come by. Thus, the relative precision of measurement and the representativeness of the sample demand this exhibition.

In performing the tabulations and analyses reported here, we have emphasized three things:

- group performance difference measurements which are free of the scoring metric of the tests used;
- trends, or lacks thereof, over grades;
- potential and actual differences in performance levels and profiles over test contents.

In taking this approach we have emphasized the relative magnitude of such group differences, comparing them <u>across</u> family characteristics (e.g., poverty vs. parent education effects), grades, and tests (e.g., reading comprehension vs. mathematics computation). We hope that this task will strengthen our grasp of the important facts which must precurse sound educational policies.

1.1 THE DATA BASE

The Sustaining Effects Study, carried out by System Development Corporation, included the collection of achievement test data from a large representative sample of pupils in grades one through six. Data were collected in fall of 1976 using tests of vocabulary, reading comprehension, mathematics concepts, and mathematics computation. The sampling design and procedures employed in this extensive data collection are described in Sustaining Effects Study Technical Report Number 1 (Hoepfner, Zagorski and Wellisch, 1977). For a representative subsample of the same pupils, Decima Research collected extensive, detailed information on home background and economic status. Together, these background and achievement data can be used to answer important questions about the concommitants of academic achievement. Findings concerning the relation of achievement to maternal education, poverty, and racial/ethnic identification are presented in this report. Trends in these relationships across grade level can be charted, and the strength of relationships can be compared for the different content areas tested. In the course of performing analyses of achievement for difference subpopulations, the frequencies for the subpopulations themselves were generated, and these are also reported. All tabulations reported are nationally representative.

1.2 DESCRIBING ACHIEVEMENT DIFFERENCES

One of the major strengths of the data base is the inclusion of different grade levels and different content areas. Unfortunately, different grades and different content areas required different test instruments. It is not meaningful to ask whether an absolute level of performance on a test

in one content area is the same as an absolute level of performance in another area, or even on a different test in the same area, except under very special conditions. However, it is both feasible and desirable to compare the relative performance of different groups on different tests. All of the questions addressed in this report which involve achievement can be framed in this way. For example, by dividing the sample at a given grade level into subgroups according to maternal education and asking about the relative perform nce of these groups on a test of reading comprehension, the relation of maternal education and reading comprehension at that grade level is addressed. When the same analysis is done using a test of e.g., mathematics computation, we can say whether the performance of low-maternal-education and high-maternal-education children is more similar in reading comprehension or in mathematics computation, and thereby compare the strength of the relationships in these two content areas.

In order to make this kind of comparison, a method was needed to express the differences between distributions of achievement for two groups which did not depend on the particular test used. The details of this method are explained in a paper by Thrash, Haertel, & Wiley (1979), but a summary is as follows.

The achievement distribution for a given group on a given test is completely described by a list giving the proportion of the group scoring at or below each successive score. That is, the list gives the proportion with a score of 0; the proportion with a score of 0 or 1; the proportion scoring 0, 1, or 2, etc. If a similar list is constructed for a second

group and the successive values on one list are paired with the corresponding values on the other, the resulting set of pairs provides a description of the relative performance of the two groups which does not depend at all on the scale of the original test. Once this is done, a new scale may be chosen to make the distribution for one group normal with a mean of zero and a standard deviation of 1. Then, using this new scale, the mean and standard deviation for the second group are computed. We would refer to the first group as the reference group and the second as the comparison group. The mean and standard deviation computed for the comparison group using the scale fixed for the reference group are called the relative mean and relative standard deviation, and together they provide a summary of the comparison group's performance relative to the reference group which does not depend on the particular test used. Since the reference group's mean was fixed at 0, the comparison group mean is equal to the difference between the means for the two groups, in reference-group standard deviations. Since the reference group's standard deviation was fixed at 1, the comparison group standard deviation is equal to the ratio of the standard deviations for the two groups. The relative mean and relative standard deviation summarize the differences in achievement for the two groups with two easily interpreted numbers. For the analyses in this report, the reference group was always taken to be the entire population. It should be pointed out that this procedure does not depend strongly on any assumptions of normality. A normal shape is imposed arbitrarily on the reference group distribution, and the mean and standard deviation of the comparison group are used to summarize group differences, simply because means and standard deviations are familiar and readily interpretable distributional summaries.

2. MATERNAL EDUCATION BY RACE BY POVERTY BY ACHIEVEMENT

This paper has three purposes. First, to present some major findings of the analyses performed; second, to provide the reader with access to the detailed information in Tables 2.1 through 2.6; and third, to illustrate the statistical methods employed so as to aid other researchers in applying the same methods. In the remainder of this paper, a series of questions are answered, concerning the relations of poverty, maternal education, race and achievement.

Poverty and maternal education reflect the economic and educational components of socioeconomic status. By tabulating these two variables against racial/ethnic identification and examining acheivement patterns over cells and across content areas and grades, the following questions are among those which can be addressed.

1. What are the relative magnitudes of the effects of maternal education and poverty on achievement?

2. Are the effects of maternal education and poverty the same for the three racial/ethnic groups?

3. How do the effects of maternal education and poverty differ across content areas?

4. To what extent are racial/ethnic differences in achievement eliminated by controlling for poverty or maternal education?

5. Do the gaps is achievement between racial/ethnic groups increase with increasing grade ("Fanspread hypothesis")?

6. What is the distribution of maternal education among the three racial/ethnic groups, and among poor and non-poor populations?

In this section, each of these six questions will be treated in detail. It should be noted that the word "effect" is used in stating these questions for the sake of brevity and clarity. These data do not permit tests of any causal hypotheses, and discussions of "the effect of X on Y" should not be taken to imply any causal connection.

2.1 THE VARIABLES AND THE TABLES

The poverty, race, and maternal educational variables are briefly described below, and the achievement tests are listed. Tabulations of achievement by each of race, mother's education, and poverty, as well as tabulations of achievement by each possible pair of these three effects are included in this section.

Brief descriptions of the variables for this tabulation are as follows:

Maternal Education refers to the educational level of the woman in the household. It is coded into three levels. The lowest is high school dropout; the second is high school graduate or high school graduate plus some college; and the highest level is college graduate.

Race refers to racial/ethnic identification. The three levels are white - nonHispanic; black - nonHispanic; and Hispanic. Persons of other races (asians, American Indians, etc.) are excluded from the tabulations involving race.

Poverty refers to the 1975 Orshansky poverty definition. On the basis of family size and other characteristics, an income cutoff is established, according to which each household is classified as either poor or non-poor.

Achievement in each of the four areas was measured using two different tests. These were successive levels of the CTBS form S tests for that content area, including the recommended level for each grade (at grade level) and the next lower level (below grade level). The four content areas tested were Vocubulary, Reading Comprehension, Mathematics Concepts, and Mathematics Computation.

The tables (Tables 2.1-2.6) all follow the same format. For each grade, for each test, relative means are presented for all subgroups. These relative means describe the achievement of each subgroup relative to the total population. Successive grades are in adjacent columns to facilitate inspection for trends across grades. At the end of the table, following the last test, proportions of the population at each grade level in each subgroup are presented, along with the weighted total group size for that grade level. The weighted total group size is simply the sum of the weights for all pupils included at that grade level. Each weight sum is approximately equal to the actual number of pupils tested at that grade level. A procedure for using these data to approximate standard errors for table entries is described in Appendix A.

2.2 AT VS. BELOW GRADE LEVEL TESTS

The at-grade-level and below-grade-level tests in each content area should theoretically give the same results. Differences between the at and

below tests in the relative means for a given group reflect both the random variations which would be expected from one replication to another and systematic differences between the content of the two tests. Thus, comparing results according to the at- and below-grade-level tests in a given content area gives some indication of the amount of error in the procedure. The discrepancy will be larger than would be expected if the same test were given twice to the same children, and smaller than would be expected if the at and below tests were given to two different samples of children.

2.3 ANSWERING THE QUESTIONS

2.3.1 The Relative Magnitude of Effects of Maternal Education and Poverty on Achievement

The table for Woman's Education (Table 2.1) shows the relation of maternal education to achievement, as measured at six grade levels using eight tests at each level. Each individual number for one subgroup at one grade on one test gives the difference between that subgroup's performance and the whole sample's performance, in standard deviation units. Thus, in the woman's education table (Table 2.1) on the first line in the first column the value -.580 indicates that on the below-grade-level vocabulary test first graders whose mothers had not completed high-school scored almost six tenths of a standard deviation below the mean for all first graders tested. The first problem is to get a quick overview of all these data, to summarize the maternal education effect.

As will generally be the case with these data, no consistent trends across the six grades appear on first inspection. Accordingly, we might begin by taking medians across grades for each of the eight tests. These are summarized below:

	< HS		HS		COLLEGE	
	Below	At	Below	At	Below	At
Vocabulary	-.52	-.47	.15	.12	.64	.71
Reading Comp.	-.49	-.44	.14	.11	.54	.59
Math Concepts	-.49	-.43	.14	.12	.55	.58
Math Comp.	-.35	-.27	.09	.08	.49	.43

The medians tabled in this way show a fairly clear pattern of effects. The first point to note is that the below-grade-level tests show larger effects (are further from the mean) at the <HS and HS levels while the at grade level tests, with the exception of Math Computation, show larger effects in the College level. This pattern is not at all surprising. The better the match between the difficulty level of the test and the ability level of the population, the higher the internal consistency reliability of the measurement. The higher the reliability, the lower the degree of "regression toward the mean." KR-21 reliabilities were consistently higher on the at-grade-level tests and lower on the below-grade-level tests for College than for the other two groups.

The second point to note is that effects are largest for vocabulary, smallest for mathematics computation, and intermediate for reading comprehension and mathematics concepts. This also makes sense. The relation of maternal education to achievement is largest in the area which would be expected to be most influenced by home environment, smallest in the area least influenced by home environment, and intermediate in the other two areas.

Finally, we may note that the effects are highly consistent. Setting aside math computation, the largest at - below difference is only .07 standard deviation units (for vocabulary in the College sample) and the largest content difference is .13 standard deviations (vocabulary vs. math concepts, at grade level, College sample). Average differences between the three levels of maternal education are much larger - roughly .55 standard deviation between dropout and high school graduate, and .45 standard deviation between high school graduate and college graduate.

On the basis of this examination, we may take the reading comprehension below grade level test as typical of the eight tests, and use the median values for that test to represent maternal education: -.47 for high school dropout, .14 for high school graduate, and .54 for college graduate.

Turning to the table for poverty (Table 2.2), there again appears to be no strong trend over grade levels, so a table of medians over grades may be constructed as before:

	Poor		Non-Poor	
	Below	At	Below	At
Vocabulary	-.64	-.57	.13	.13
Reading Comp.	-.59	-.51	.12	.11
Math Concepts	-.59	-.52	.12	.11
Math Comp.	-.50	-.40	.10	.08

Contrasts between the below- and at-grade-level tests and comparisons across the four content areas show the same patterns as for maternal education. Between-test differences are all very small relative to the difference between poor and non-poor. Again choosing reading comprehension below as typical, representative means for poor and non-poor groups are -.59 and .12, respectively.

It is now possible to compare the size of the effects of maternal education and poverty on achievement. The gap between high school dropout and high school graduate is about .61, the high school graduate - college graduate gap is .40, and the poor - non-poor gap is .71. Thus, the gap between the lowest and highest levels of maternal education, .61 plus .40, is over 40 percent greater than the poor - non-poor gap, but the poor - non-poor gap exceeds both the dropout - high school gap and the high school - college gap.

2.3.2 Effects of Maternal Education and Poverty Controlling for Race

Using the tables for Woman's Education by Race (Table 2.5) and for Poverty by Race (Table 2.6), effects of maternal education and poverty controlling for race can be calculated. Turning first to maternal education and selecting reading comprehension below-grade level as typical, the following are the medians over grades from the Woman's Education by Race Table.

	<HS	HS	COLLEGE
White	-.24	.26	.67
Black	-.90	-.56	-.08*
Hispanic	-.83	-.28	-.23*

* Unstable due to small sample size.

Not controlling for race, the dropout - high school graduate gap was .61. Gaps obtained for white, black, and Hispanic are .50, .34 and .55, which average .46. Thus, controlling for race reduced the dropout - high school graduate gap by (.61 - .46)/.61 = 25 percent. The corresponding figures for the high school graduate - college graduate gap are .41, .48, and .05, averaging .31, again a reduction of roughly 25 percent, but the figures for Hispanic college graduate should be used with caution, as sample sizes are quite small.

The median poor - non-poor gaps by race for reading comprehension below-grade-level are as follows:

	Poor	Non-Poor
White	-.29	.23
Black	-.87	-.50
Hispanic	-.92	-.52

White, Black, and Hispanic gaps are .52, .37, and .40, averaging .43, indicating a 40 percent reduction from the uncontrolled gap of .71 standard deviation.

In conclusion, when race is controlled the poor - non-poor gap is roughly equal to the dropout - high school graduate gap, about .4 standard deviation. The high school graduate - college graduate gap is smaller, roughly .3 standard deviation.

2.3.3 Differences in Maternal Education and Poverty Effects Across Content Areas

The tables of medians presented in section 2.3.1 may be used to examine content differences in maternal education and poverty effects. For both maternal education and poverty, small but systematic content differences appear. For maternal eduation, the dropout - college gaps for the four

content areas were 1.16, 1.01, 1.04, and .84 using the below-grade-level tests, and 1.18, 1.13, 1.01, and .70 using the at-grade-level tests. Averaging the below- and at-grade-level figures for each content area, the effects for vocabulary, reading comprehension, math concepts and math computation are 1.17, 1.02, 1.03, and .77 standard deviations, respectively. Taking reading comprehension as the base, maternal education effects are roughly 15 percent larger for vocabulary, 25 percent smaller for math computation, and of equal size for math concepts. Corresponding figures for poverty effects in the four content areas are .74, .67, .67, and .54. Again taking reading comprehension as the base, poverty effects are roughly 10 percent larger for vocabulary, 20 percent smaller for mathematics computation, and of equal size for mathematics concepts. In conclusion, vocabulary is most strongly related to differences in either poverty status or maternal education, and mathematics computation is least affected by such differences. Relative variation is somewhat greater with maternal education than with poverty.

2.3.4 Race Differences Controlling for Poverty or Maternal Education

The tables presented in section 2.3.2 provide information on race differences controlled for maternal education and poverty. Medians across grades for each test for each race from Table 2.3 are presented below. These

show the uncontrolled race effect to which the controlled effects are to be compared.

	WHITE		BLACK		HISPANIC	
	Below	At	Below	At	Below	At
Vocabulary	.19	.17	-.80	-.63	-.72	-.65
Reading Comp.	.18	.16	-.70	-.59	-.64	-.60
Math Concepts	.17	.16	-.68	-.61	-.67	-.62
Math Comp.	.14	.12	-.56	-.43	-.35	-.34

The below- vs. at-grade-level differences noted earlier also appear for race. For all three racial/ethnic groups, mean deviations are larger for the below-grade-level tests in all four content areas. Differences between at- and below-grade-level tests are smallest for the white group, where the at-grade-level tests are most nearly of appropriate difficulty. Patterns of content differences for the racial/ethnic groups are similar to those described earlier for groups defined by maternal education or poverty, except that some race-by-content interaction is evident. Content differences are smaller for the white group and larger for the minority groups. Overall, reading comprehension below-grade-level still appears to be an appropriate "typical" test for purposes of comparison.

The uncontrolled racial/ethnic gaps on the reading comprehension below-grade-level test are .88 (white - black) and .92 (white - Hispanic).

Corresponding gaps controlling for maternal eduation or poverty are as follows:

	White - Black	White - Hispanic
Mother dropout	.66	.59
Mother HS graduate	.82	.54
Mother College graduate	.75	.90
Poor	.58	.63
Non-poor	.73	.75
Overall	.88	.82

The white - black gap among the poor is only two-thirds as large as the uncontrolled gap, and among the non-poor the white - black gap is roughly five-sixths of the uncontrolled figure. This discrepancy may reflect the greater heterogeneity of income levels in the non-poor group; economic status is held more nearly constant by fixing poverty = poor than by fixing poverty = non-poor. Controlling maternal education does not affect the black - white gap as much. The mean black - white gap controlling for maternal education is (.66 + .82 + .75)/3 or .74, a reduction of (.88 - .74)/.88 or 16 percent over the uncontrolled figure. The corresponding reduction in the white - Hispanic gap when maternal education is controlled is 17 percent. Controlling for poverty status reduces the white - Black and white - Hispanic gaps by 26 percent and 16 percent, respectively.

2.3.5 The "Fanspread" Hypothesis

No clear patterns across the six grade levels were noted in any of the tables discussed thus far. To probe the effect of grade more carefully, medians across all eight tests at each grade level (seven tests for grade 1) were taken for each racial/ethnic group. Results were as follows:

GRADE	1	2	3	4	5	6
White	.12	.14	.19	.18	.19	.14
Black	-.40	-.55	-.68	-.62	-.72	-.63
Hispanic	-.39	-.51	-.67	-.64	-.60	-.67

There is evidence in this table of a trend across the first three grade levels, but overall, the hypothesis that gaps between racial/ethnic groups should increase with increasing grade level is not supported. The trend over grades 1 - 3 may be due in part to increasing reliability as older children are tested and to content discrepancies between grades 1 and 2 and the later grades.

Our basic methodology for looking at group differences can be thought of as focussing on distributional "overlap". If the median of one group's distribution, for example, is at the 25th precentile of another's and this is true in every grade, our procedures will find no grade-level increase in the "gap" separating these groups. If the same test is given at several grade levels, however, total variances at higher grade levels could be

found to be larger relative to those in lower grades. If this were the case, gaps between advantaged and disadvantaged groups, measured in the metric of the lower grade distribution, could be found to increase even though the "overlap" between distributions did not change. However, under these circumstances, this seeming increase in variance could be eliminated by a scale transformation. Only if the ("overlap") indices of group difference used in this report also increased, would such a transformation not be able to remove the widening gap. Therefore, since test performance metrics of all kinds are generally assumed to be abitrary and, consequently, subject to any monotonic transformation, the truth of the "fan spread" hypothesis -- at least in the elementary grades -- would seem to depend on the performance metric used.

2.3.6 The Distribution of Maternal Education for Each Race and For Poor and Non-poor

The last section of Tables 2.1 through 2.6 present proportions of the populations in each cell, for each grade level. These figures serve two purposes. First, results for small cells are less stable than for larger cells, so knowing the proportion in each cell is important in judging the relative accuracy of values in the table. These cell sizes can in fact be used to compute the standard errors of table entries, as described in Appendix A. In addition to indicating the accuracy of table entries, cell sizes are of interest in themselves. For most purposes, it should be

sufficient to inspect the proportions across the six grades to form an idea of the relative sizes of different cells. However, to illustrate the procedure for recovering more information from these data, the tables below were prepared, using the Woman's Education by Race and Woman's Education by Poverty tables (Tables 2.4 and 2.5).

MATERNAL EDUCATION

Race	<HS	HS	COLLEGE	TOTAL
White	.200	.505	.089	.794
Black	.069	.062	.007	.138
Hispanic	.051	.016	.001	.068
TOTAL	.320	.583	.097	1.000

MATERNAL EDUCATION

Poverty Status	<HS	HS	COLLEGE	TOTAL
Poor	.108	.054	.004	.166
Non-poor	.211	.529	.094	.834
TOTAL	.319	.583	.098	1.000

The values in these tables for individual cells were obtained by averaging across the six grade levels, weighting each grade according to its total weight. Marginals were then obtained by simply summing. Differences in the marginals for each level of maternal education are due to rounding.

The tables show clear relationships between maternal education and each of race and poverty. Only .200/.794 = 25 percent of all Whites' mothers lack a high school diploma, while the corresponding figures for Black and Hispanic are 50 percent and 75 percent, respectively. Sixty-five percent and twenty-five percent of the poor and non-poor groups show maternal education less than high school. Of mothers who are college graduates, .089/.097 = 92 percent are White, and 96 percent are non-poor.

4. CONCLUSION

No important systematic differences were found in patterns of achievement within grades 1 through 6, and differences for content areas were small. The "fanspread" pattern of increasing disparity between White and minority achievement was not found. Effects were generally stronger in the higher grades and in the vocabulary content area, and weaker in the area of mathematics computation, but the rank ordering of different groups was not found to vary systematically from grade to grade or from test to test. In two-way tables, the averages for each row and column generally give a good picture of the entire cross-tabulation. For all achievement categories, levels of performance varied with racial/ethnic group, proportionately more minority pupils than White pupils having lower achievement.

Comparing other effects to the gap between a maternal educational level of less than high school (i.e., dropout) and one of college graduation, the poverty effect was 70 percent and the White-minority gaps were 90 percent

as large. When racial/ethnic group is controlled, the maternal education effect was reduced by 20 percent, while the poverty effect fell over 40 percent. Thus within racial/ethnic groups the effect of maternal education is twice as great as the effect of poverty.

In our view, the large magnitude of the parental education effects, in comparison to both racial/ethnic and economic differences in achievement, has profound policy implications for the evaluation of educational programs. Clearly, the short-term effects of such programs on educational achievement are only a part of their societal benefit. Longer-term impacts, especially for future generations, need to be carefully weighed if total benefits are not to be under valued.

Table 2.1 Mean Achievement by Motner's Education and Grade (Eight Tests)

Mother's Education	Grade 1	2	3	4	5	6
Vocabulary Test Below Grade Level						
Not High School Graduate	-0.580	-0.523	-0.505	-0.499	-0.521	-0.585
High School Graduate	0.165	0.120	0.131	0.147	0.145	0.166
College Graduate	0.659	0.615	0.447	0.716	0.529	0.749
Vocabulary Test At Grade Level						
Not High School Graduate	-0.272	-0.579	-0.458	-0.451	-0.515	-0.475
High School Graduate	0.069	0.115	0.121	0.124	0.142	0.132
College Graduate	0.405	0.831	0.637	0.748	0.678	0.747
Reading Comprehension Test Below Grade Level						
Not High School Graduate	-0.407	-0.538	-0.428	-0.451	-0.494	-0.511
High School Graduate	0.113	0.134	0.132	0.142	0.140	0.139
College Graduate	0.424	0.650	0.380	0.610	0.467	0.719
Reading Comprehension Test At Grade Level						
Not High School Graduate	-0.165	-0.456	-0.396	-0.432	-0.478	-0.463
High School Graduate	0.041	0.091	0.103	0.129	0.142	0.121
College Graduate	0.274	0.758	0.583	0.674	0.581	0.743

Table 2.1 Mean Achievement by Mother's Education and Grade (Eight Tests) - cont'd

Mother's Education	Grade 1	2	3	4	5	6
Math Concepts Test Below Grade Level						
Not High School Graduate	-0.528	-0.479	-0.388	-0.451	-0.518	-0.503
High School Graduate	0.145	0.117	0.085	0.129	0.137	0.153
College Graduate	0.535	0.515	0.608	0.596	0.456	0.560
Math Concepts Test At Grade Level						
Not High School Graduate	-0.377	-0.419	-0.444	-0.429	-0.489	-0.421
High School Graduate	0.116	0.095	0.112	0123	0.145	0.115
College Graduate	0.377	0.529	0.582	0.658	0.579	0.638
Math Computation Test Below Grade Level						
Not High School Graduate		-0.376	-0.332	-0.337	-0.374	-0.349
High School Graduate		0.081	0.078	0.088	0.096	0.094
College Graduate		0.492	0.464	0.582	0.429	0.511
Math Computation Test At Grade Level						
Not High School Graduate	-0.245	-0.328	-0.224	-0.275	-0.399	-0.259
High School Graduate	0.077	0.073	0.034	0.090	0.111	0.050
College Graduate	0.252	0.423	0.435	0.357	0.531	0.547
Proportion in Each Group, by Grade						
Not High School Graduate	0.282	0.277	0.295	0.312	0.301	0.294
High School Graduate	0.606	0.600	0.592	0.591	0.592	0.617
College Graduate	0.110	0.123	0.114	0.097	0.107	0.089
Total Weight for Each Grade	2300.006	2049.089	2075.745	1953.464	1936.687	2346.341

NOTE: A blank space indicates only the at-grade-level math computation test was administered at grade 1.

Table 2.2 Mean Achievement by Poverty Status and Grade (Eight Tests)

Poverty Status	Grade 1	2	3	4	5	6
Vocabulary Test Below Grade Level						
Poor	-0.648	-0.601	-0.759	-0.637	-0.628	-0.665
Non-poor	0.131	0.120	0.157	0.144	0.122	0.116
Vocabulary Test At Grade Level						
Poor	-0.229	-0.668	-0.586	-0.552	-0.[illegible]	-0.533
Non-poor	0.049	0.137	0.134	0.129	0.121	0.099
Reading Comprehension Test Below Grade Level						
Poor	-0.571	-0.606	-0.651	-0.556	-0.604	-0.560
Non-poor	0.116	0.124	0.152	0.127	0.119	0.098
Reading Comprehension Test At Grade Level						
Poor	-0.160	-0.471	-0.549	-0.484	-0.531	-0.540
Non-poor	0.033	0.106	0.129	0.112	0.108	0.098
Math Concepts Test Below Grade Level						
Poor	-0.608	-0.570	-0.558	-0.649	-0.621	-0.576
Non-poor	0.116	0.118	0.123	0.140	0.112	0.101
Math Concepts Test At Grade Level						
Poor	-0.422	-0.489	-0.675	-0.508	-0.556	-0.530
Non-poor	0.084	0.101	0.145	0.115	0.110	0.096

Table 2.2 Mean Achievement by Poverty Status and Grade (Eight Tests) - cont'd

Poverty Status	Grade 1	2	3	4	5	6
Math Computation Test Below Grade Level						
Poor		-0.509	-0.521	-0.502	-0.489	-0.429
Non-poor		0.102	0.117	0.113	0.085	0.076
Math Computation Test At Grade Level						
Poor	-0.292	-0.391	-0.407	-0.329	-0.426	-0.402
Non-poor	0.059	0.080	0.092	0.075	0.086	0.073
Proportion in Each Group, by Grade						
Poor	0.164	0.170	0.181	0.182	0.164	0.148
Non-poor	0.836	0.830	0.819	0.818	0.836	0.852
Total Weight for Each Grade	2719.648	2400.913	2450.157	2318.899	2313.112	2704.318

NOTE: A blank space indicates only the at-grade-level math computation test was administered at grade 1.

Table 2.3 Mean Achievement by Racial/Ethnic Group and Grade (Eight Tests)

Racial/Ethnic	Grade 1	2	3	4	5	6
Vocabulary Test Below Grade Level						
White	0.182	0.132	0.216	0.216	0.195	0.171
Black	-0.659	-0.488	-0.870	-0.795	-0.797	-0.804
Hispanic	-0.420	-0.589	-0.922	-0.729	-0.716	-0.871
Vocabulary Test At Grade Level						
White	0.073	0.173	0.200	0.184	0.192	0.135
Black	-0.196	-0.647	-0.694	-0.616	-0.731	-0.596
Hispanic	-0.310	-0.656	-0.700	-0.657	-0.608	-0.650
Reading Comprehension Test Below Grade Level						
White	0.165	0.171	0.212	0.189	0.188	0.158
Black	-0.571	-0.605	-0.754	-0.655	-0.750	-0.752
Hispanic	-0.494	-0.628	-0.793	-0.645	-0.571	-0.762
Reading Comprehension Test At Grade Level						
White	0.040	0.136	0.185	0.173	0.186	0.141
Black	-0.062	-0.446	-0.610	-0.564	-0.703	-0.665
Hispanic	-0.270	-0.501	-0.635	-0.643	-0.583	-0.619

Table 2.3 Mean Achievement by Racial/Ethnic Group and Grade (Eight Tests) - cont'd

Racial/Ethnic	Grade 1	2	3	4	5	6
Math Concepts Test Below Grade Level						
White	0.174	0.155	0.173	0.191	0.180	0.149
Black	-0.622	-0.642	-0.637	-0.709	-0.788	-0.745
Hispanic	-0.556	-0.514	-0.715	-0.725	-0.646	-0.685
Math Concepts Test At Grade Level						
White	0.116	0.140	0.213	0.177	0.187	0.133
Black	-0.399	-0.548	-0.793	-0.629	-0.704	-0.596
Hispanic	-0.389	-0.486	-0.804	-0.605	-0.629	-0.698
Math Computation Test Below Grade Level						
White		0.137	0.163	0.135	0.130	0.092
Black		-0.559	-0.631	-0.560	-0.591	-0.502
Hispanic		-0.455	-0.511	-0.335	-0.282	-0.349
Math Computation Test At Grade Level						
White	0.088	0.114	0.132	0.099	0.134	0.075
Black	-0.314	-0.491	-0.507	-0.348	-0.504	-0.376
Hispanic	-0.251	-0.282	-0.391	-0.365	-0.445	-0.312
Proportion in Each Group, by Grade						
White	0.775	0.793	0.786	0.784	0.787	0.829
Black	0.151	0.138	0.143	0.145	0.154	0.112
Hispanic	0.074	0.069	0.071	0.071	0.060	0.059
Total Weight for Each Grade	2696.138	2411.270	2447.269	2311.785	2302.719	2713.648

NOTE: A blank space indicates only the at-grade-level math computation test was administered at grade 1.

Table 2.4 Mean Achievement by Mother's Education, Poverty Status, and Grade (Eight Tests)

Mother's Ed	Poverty Status	Grade 1	2	3	4	5	6
Vocabulary Test Below Grade Level							
Not High School Graduate	Poor	-0.800	-0.755	-0.978	-0.844	-0.802	-0.842
	Nonpoor	-0.407	-0.379	-0.246	-0.343	-0.356	-0.450
High School Graduate	Poor	-0.342	-0.363	-0.419	-0.250	-0.332	-0.391
	Nonpoor	0.239	0.191	0.222	0.237	0.223	0.238
College Graduate	Poor	-0.493	0.290	0.530	0.736	-0.355	1.005
	Nonpoor	0.768	0.652	0.525	0.816	0.623	0.792
Vocabulary Test At Grade Level							
Not High School Graduate	Poor	-0.281	-0.813	-0.746	-0.727	-0.767	-0.660
	Nonpoor	-0.241	-0.424	-0.307	-0.319	-0.368	-0.367
High School Graduate	Poor	-0.099	-0.472	-0.371	-0.225	-0.275	-0.334
	Nonpoor	0.102	0.199	0.208	0.204	0.220	0.193
College Graduate	Poor	-	0.440	0.908	0.850	-0.432	0.610
	Nonpoor	0.429	0.887	0.721	0.842	0.740	0.792

NOTE: A dash (-) indicates insufficient sample size to estimate mean achievement.

Table 2.4 Mean Achievement by Mother's Education, Poverty Status, and Grade (Eight Tests) - cont'd

Mother's Ed	Poverty Status	Grade 1	2	3	4	5	6
Reading Comprehension Test Below Grade Level							
Not High School Graduate	Poor	-0.695	-0.811	-0.831	-0.712	-0.786	-0.727
	Nonpoor	-0.255	-0.404	-0.227	-0.328	-0.327	-0.397
High School Graduate	Poor	-0.281	-0.297	-0.383	-0.219	-0.315	-0.343
	Nonpoor	0.189	0.214	0.235	0.222	0.221	0.203
College Graduate	Poor	0.133	0.251	0.394	0.190	0.057	1.045
	Nonpoor	0.447	0.737	0.483	0.714	0.545	0.757
Reading Comprehension Test At Grade Level							
Not High School Graduate	Poor	-0.188	-0.570	-0.665	-0.629	-0.681	-0.665
	Nonpoor	-0.130	-0.351	-0.250	-0.331	-0.355	-0.367
High School Graduate	Poor	-0.024	-0.317	-0.403	-0.199	-0.270	-0.364
	Nonpoor	0.060	0.150	0.185	0.195	0.217	0.191
College Graduate	Poor	-0.123	0.648	0.682	0.364	-0.332	1.087
	Nonpoor	0.237	0.821	0.691	0.788	0.634	0.783

Table 2.4 Mean Achievement by Mother's Education, Poverty Status, and Grade (Eight Tests) - cont'd

Mother's Ed	Poverty Status	Grade 1	2	3	4	5	6
Math Concepts Test Below Grade Level							
Not High School Graduate	Poor	-0.762	-0.695	-0.715	-0.857	-0.818	-0.731
	Nonpoor	-0.368	-0.375	-0.228	-0.283	-0.354	-0.383
High School Graduate	Poor	-0.299	-0.388	-0.316	-0.256	-0.310	-0.342
	Nonpoor	0.213	0.204	0.164	0.218	0.214	0.218
College Graduate	Poor	-0.936	0.121	0.500	0.056	-0.183	0.721
	Nonpoor	0.582	0.563	0.688	0.682	0.556	0.598
Math Concepts Test At Grade Level							
Not High School Graduate	Poor	-0.478	-0.600	-0.859	-0.664	-0.714	-0.626
	Nonpoor	-0.274	-0.301	-0.243	-0.310	-0.342	-0.326
High School Graduate	Poor	-0.309	-0.356	-0.426	-0.233	-0.279	-0.461
	Nonpoor	0.165	0.153	0.206	0.193	0.211	0.190
College Graduate	Poor	-	0.397	0.859	0.342	-0.329	0.806
	Nonpoor	0.416	0.575	0.653	0.741	0.618	0.663

NOTE: A dash (-) indicates insufficient sample size to estimate mean achievement

Table 2.4 Mean Achievement by Mother's Education, Poverty Status, and Grade (Eight Tests) - cont'd

Mother's Ed	Poverty Status	Grade 1	2	3	4	5	6
Math Computation Test Below Grade Level							
Not High School Graduate	Poor		-0.599	-0.663	-0.631	-0.601	-0.480
	Nonpoor		-0.285	-0.168	-0.207	-0.228	-0.269
High School Graduate	Poor		-0.418	-0.348	-0.255	-0.287	-0.400
	Nonpoor		0.159	0.149	0.158	0.139	0.151
College Graduate	Poor		0.449	0.466	-0.186	0.028	0.752
	Nonpoor		0.533	0.563	0.701	0.473	0.513
Math Computation Test At Grade Level							
Not High School Graduate	Poor	-0.320	-0.452	-0.468	-0.441	-0.519	-0.455
	Nonpoor	-0.195	-0.258	-0.122	-0.196	-0.311	-0.163
High School Graduate	Poor	-0.208	-0.358	-0.347	-0.158	-0.263	-0.367
	Nonpoor	0.119	0.131	0.105	0.136	0.172	0.099
College Graduate	Poor	-0.203	0.414	0.044	0.251	-0.112	-
	Nonpoor	0.280	0.462	0.503	0.427	0.550	0.570

NOTE: A blank space indicates only the at-grade-level math computation test was administered at grade 1.

A dash (-) indicates insufficient sample size to estimate mean achievement.

Table 2.4 Mean Achievement by Mother's Education, Poverty Status, and Grade (Eight Tests) - cont'd

Mother's Ed	Poverty Status	Grade 1	2	3	4	5	6
Proportion in Each Group, by Grade							
No High School Graduate	Poor	0.110	0.104	0.116	0.116	0.105	0.100
	Nonpoor	0.204	0.191	0.204	0.222	0.227	0.220
High School Graduate	Poor	0.051	0.059	0.056	0.061	0.053	0.045
	Nonpoor	0.534	0.532	0.522	0.512	0.517	0.551
College Graduate	Poor	0.002	0.006	0.005	0.003	0.003	0.002
	Nonpoor	0.099	0.108	0.096	0.085	0.095	0.082
Total Weight for Each Grade		2618.439	2332.835	2375.737	2245.256	2241.590	2604.52

Table 2.5 Mean Achievement by Mother's Education, Racial/Ethnic Group and Grade (Eight Tests)

Mother's Education	Racial/Ethnic	Grade 1	2	3	4	5	6
Vocabulary Test Below Grade Level							
Not a High School Graduate	White	-0.397	-0.356	-0.181	-0.240	-0.244	-0.360
	Black	-0.930	-0.778	-1.042	-0.975	-0.945	-1.053
	Hispanic	-0.529	-0.782	-1.015	-0.905	-0.911	-1.034
High School Graduate	White	0.289	0.196	0.279	0.297	0.282	0.287
	Black	-0.474	-0.253	-0.760	-0.634	-0.649	-0.626
	Hispanic	-0.191	-0.205	-0.781	-0.344	-0.023	-0.365
College Graduate	White	0.855	0.697	0.582	0.908	0.620	0.828
	Black	0.072	-0.092	0.120	0.032	-0.483	0.116
	Hispanic	0.419	-	0.046	0.382	-0.110	-
Vocabulary Test At Grade Level							
Not a High School Graduate	White	-0.217	-0.393	-0.234	-0.283	-0.275	-0.338
	Black	-0.310	-0.845	-0.828	-0.756	-0.892	-0.733
	Hispanic	-0.314	-0.856	-0.774	-0.709	-0.801	-0.730
High School Graduate	White	0.126	0.233	0.274	0.260	0.281	0.237
	Black	-0.122	-0.539	-0.619	-0.486	-0.587	-0.513
	Hispanic	-0.303	-0.187	-0.617	-0.562	0.005	-0.395
College Graduate	White	0.456	-0.948	0.775	0.954	0.776	0.818
	Black	0.109	-0.209	0.335	-0.065	-0.298	0.180
	Hispanic	-0.093	-	0.242	-0.124	0.472	-

NOTE: A dash (-) indicates insufficient sample size to estimate mean achievement.

Table 2.5 Mean Achievement by Mother's Education, Racial/Ethnic Group and Grade (Eight Tests)- cont'd

Mother's Education	Racial/Ethnic	Grade 1	2	3	4	5	6
Reading Comprehension Test Below Grade Level							
Not a High School Graduate	White	-0.232	-0.340	-0.147	-0.248	-0.240	-0.306
	Black	-0.755	-0.922	-0.879	-0.791	-0.917	-0.923
	Hispanic	-0.570	-0.841	-0.896	-0.764	-0.758	-0.938
High School Graduate	White	0.253	0.252	0.284	0.273	0.280	0.253
	Black	-0.476	-0.389	-0.686	-0.508	-0.603	-0.637
	Hispanic	-0.410	-0.107	-0.652	-0.318	-0.014	-0.246
College Graduate	White	0.463	0.790	0.507	0.809	0.558	0.801
	Black	0.216	-0.078	-	-0.104	-0.268	0.021
	Hispanic	-0.374	-	-	-0.089	-	-
Reading Comprehension Test At Grade Level							
Not a High School Graduate	White	-0.109	-0.349	-0.194	-0.271	-0.260	-0.310
	Black	-0.132	-0.574	-0.681	-0.656	-0.824	-0.868
	Hispanic	-0.318	-0.562	-0.712	-0.725	-0.729	-0.699
High School Graduate	White	0.064	0.188	0.243	0.252	0.285	0.230
	Black	0.004	-0.385	-0.593	-0.493	-0.590	-0.525
	Hispanic	-0.086	-0.295	-0.484	-0.488	-0.142	-0.304
College Graduate	White	0.270	0.886	0.728	0.878	0.671	0.815
	Black	-0.040	0.003	0.432	-0.049	-0.150	0.281
	Hispanic	-	-	0.116	-	-0.021	-

NOTE: A dash (-) indicates insufficient sample size to estimate mean achievement.

Table 2.5 Mean Achievement by Mother's Education, Racial/Ethnic Group and Grade (Eight Tests) - cont'd

Mother's Education	Racial/Ethnic	Grade 1	2	3	4	5	6
Math Concepts Test Below Grade Level							
Not a High School Graduate	White	-0.346	-0.299	-0.173	-0.243	-0.267	-0.325
	Black	-0.806	-0.839	-0.759	-0.824	-0.939	-0.920
	Hispanic	-0.661	-0.746	-0.787	-0.895	-0.882	-0.806
High School Graduate	White	0.278	0.225	0.209	0.270	0.280	0.267
	Black	-0.529	-0.480	-0.543	-0.632	-0.656	-0.602
	Hispanic	-0.337	0.043	-0.539	-0.316	-0.013	-0.319
College Graduate	White	0.631	0.607	0.763	0.752	0.538	0.626
	Black	0.034	-0.535	0.289	0.063	-0.404	0.017
	Hispanic	-0.029	-	-0.148	-0.093	-	-
Math Concepts Test At Grade Level							
Not a High School Graduate	White	-0.244	-0.241	-0.171	-0.219	-0.280	-0.264
	Black	-0.547	-0.700	-0.916	-0.786	-0.745	-
	Hispanic	-0.443	-0.658	-0.911	-0.716	-0.778	-0.811
High School Graduate	White	0.196	0.180	0.275	0.241	0.288	0.217
	Black	-0.321	-0.432	-0.718	-0.508	-0.660	-0.510
	Hispanic	-0.319	-0.104	-0.690	-0.366	-0.128	-0.299
College Graduate	White	0.469	0.641	0.696	0.797	0.676	0.695
	Black	-0.103	-0.280	0.196	0.194	-0.473	0.171
	Hispanic	0.179	-	-	-	0.248	-

NOTE: A dash (-) indicates insufficient sample size to estimate mean achievement.

Table 2.5 Mean Achievement by Mother's Education, Racial/Ethnic Group and Grade (Eight Tests) - cont'd

Mother's Education	Racial/Ethnic	Grade 1	2	3	4	5	6
Math Computation Test Below Grade Level							
Not a High School Graduate	White		-0.199	-0.139	-0.224	-0.196	-0.255
	Black		-0.799	-0.707	-0.658	-0.740	-0.632
	Hispanic		-0.612	-0.604	-0.410	-0.380	-0.372
High School Graduate	White		0.170	0.197	0.194	0.184	0.168
	Black		-0.409	-0.577	-0.491	-0.420	-0.414
	Hispanic		-0.035	-0.250	-0.195	-0.119	-0.185
College Graduate	White		0.595	0.588	0.751	0.509	0.532
	Black		-0.160	0.311	-0.031	-0.477	0.233
	Hispanic		-	0.079	0.410	0.241	-
Math Computation Test At Grade Level							
Not a High School Graduate	White	-0.158	-0.217	-0.081	-0.189	-0.251	-0.196
	Black	-0.391	-0.631	-0.545	-0.459	-0.621	-0.433
	Hispanic	-0.323	-0.370	-0.428	-0.366	-0.532	-0.334
High School Graduate	White	0.143	0.160	0.141	-0.164	0.207	0.110
	Black	-0.251	-0.436	-0.482	-0.228	-0.355	-0.357
	Hispanic	-0.081	-0.095	-0.220	-0.521	-0.166	-0.141
College Graduate	White	0.336	0.520	0.536	0.474	0.621	0.579
	Black	-0.242	-0.143	0.057	0.052	-0.546	0.373
	Hispanic	-	-	-0.534	-0.170	-0.153	-

NOTE: A blank space indicates only the at-grade-level math computation test was administered at grade 1.

A dash (-) indicates insufficient sample size to estimate mean achievement.

Table 2.5 Mean Achievement by Mother's Education, Racial/Ethnic Group and Grade (Eight Tests) - cont'd

Mother's Education	Racial/Ethnic	Grade 1	2	3	4	5	6
Proportion in Each Group, by Grade							
Not a High School Graduate	White	0.189	0.185	0.193	0.207	0.208	0.221
	Black	0.071	0.060	0.073	0.080	0.075	0.054
	Hispanic	0.054	0.049	0.055	0.052	0.049	0.044
High School Graduate	White	0.502	0.508	0.500	0.499	0.491	0.529
	Black	0.066	0.065	0.063	0.057	0.068	0.051
	Hispanic	0.018	0.018	0.016	0.017	0.011	0.016
College Graduate	White	0.089	0.104	0.092	0.079	0.090	0.079
	Black	0.010	0.005	0.006	0.008	0.007	0.004
	Hispanic	0.001	0.001	0.003	0.002	0.001	0.0002
Total Weight For Each Grade		2618.439	2332.834	2375.735	2245.257	2241.590	2604.52

Table 2.6 Mean Achievement by Poverty Status, Race, and Grade (Eight Tests)

Poverty Status	Race	Grade 1	2	3	4	5	6
Vocabulary Test Below Grade Level							
Poor	White	-0.497	-0.425	-0.331	-0.252	-0.261	-0.334
	Black	-0.896	-0.671	-1.107	-0.954	-0.945	-1.083
	Hispanic	-0.487	-0.947	-1.151	-0.914	-0.937	-0.933
Nonpoor	White	0.246	0.188	0.273	0.271	0.238	0.221
	Black	-0.503	-0.308	-0.679	-0.639	-0.660	-0.579
	Hispanic	-0.386	-0.426	-0.742	-0.626	-0.629	-0.802
Vocabulary Test At Grade Level							
Poor	White	-0.230	-0.445	-0.294	-0.268	-0.286	-0.335
	Black	-0.177	-0.817	-0.832	-0.784	-0.864	-0.803
	Hispanic	-0.364	-0.983	-0.820	-0.746	-0.824	-0.673
Nonpoor	White	0.109	0.239	0.261	0.239	0.241	0.183
	Black	-0.234	-0.508	-0.579	-0.467	-0.618	-0.410
	Hispanic	-0.293	-0.493	-0.618	-0.600	-0.533	-0.621

Table 2.6 Mean Achievement by Poverty Status, Race, and Grade (Eight Tests) - cont'd

Poverty Status	Race	Grade 1	2	3	4	5	6
Reading Comprehension Test Below Grade Level							
Poor	White	-0.340	-0.357	-0.309	-0.192	-0.279	-.227
	Black	-0.789	-0.743	-0.922	-0.839	-0.899	-.978
	Hispanic	-0.611	-0.997	-0.948	-0.795	-0.799	-.853
Nonpoor	White	0.214	0.223	0.268	0.233	0.233	.195
	Black	-0.394	-0.478	-0.598	-0.475	-0.625	-.522
	Hispanic	-0.478	-0.444	-0.671	-0.552	-0.490	-.703
Reading Comprehension Test At Grade Level							
Poor	White	-0.159	-0.355	-0.322	-0.172	-0.277	-0.297
	Black	-0.021	-0.488	-0.710	-0.699	-0.817	-0.893
	Hispanic	-0.420	-0.686	-0.772	-0.773	-0.538	-0.642
Nonpoor	White	0.063	0.191	0.247	0.214	0.232	0.184
	Black	-0.104	-0.408	-0.514	-0.439	-0.590	-0.468
	Hispanic	-0.199	-0.384	-0.531	-0.566	-0.635	-0.575

Table 2.6 Mean Achievement by Poverty Status, Race, and Grade (Eight Tests) - cont'd

Poverty Status	Race	Grade 1	2	3	4	5	6
Math Concepts Test Below Grade Level							
Poor	White	-0.438	-0.328	-0.230	-0.331	-0.225	-0.344
	Black	-0.744	-0.794	-0.832	-0.915	-1.003	-0.925
	Hispanic	-0.786	-0.749	-0.867	-0.899	-0.860	-0.665
Nonpoor	White	0.231	0.210	0.219	0.248	0.211	0.196
	Black	-0.543	-0.508	-0.440	-0.514	-0.604	-0.584
	Hispanic	-0.469	-0.406	-0.587	-0.628	-0.578	-0.661
Math Concepts Test At Grade Level							
Poor	White	-0.322	-0.302	-0.324	-0.168	-0.281	-0.337
	Black	-0.510	-0.622	-0.969	-0.784	-0.815	-0.787
	Hispanic	-0.455	-0.713	-1.021	-0.830	-0.743	-0.707
Nonpoor	White	0.164	0.186	0.275	0.217	0.233	0.182
	Black	-0.341	-0.470	-0.630	-0.495	-0.595	-0.454
	Hispanic	-0.378	-0.383	-0.645	-0.478	-0.598	-0.655

Table 2.6 Mean Achievement by Poverty Status, Race, and Grade (Eight Tests) - cont'd

Poverty Status	Race	Grade 1	2	3	4	5	6
Math Computation Test Below Grade Level							
Poor	White		-0.267	-0.264	-0.289	-0.210	-0.278
	Black		-0.741	-0.786	-0.774	-0.845	-0.711
	Hispanic		-0.687	-0.704	-0.467	-0.309	-0.322
Nonpoor	White		0.181	0.212	0.187	0.160	0.129
	Black		-0.419	-0.465	-0.364	-0.394	-0.320
	Hispanic		-0.353	-0.359	-0.289	-0.304	-0.334
Math Computation Test At Grade Level							
Poor	White	-0.219	-0.198	-0.233	-0.171	-0.227	-0.360
	Black	-0.346	-0.627	-0.633	-0.507	-0.646	-0.499
	Hispanic	-0.318	-0.385	-0.446	-0.400	-0.431	-0.382
Nonpoor	White	0.120	0.150	0.175	0.134	0.172	0.118
	Black	-0.295	-0.394	-0.384	-0.191	-0.381	-0.263
	Hispanic	-0.242	-0.247	-0.342	-0.411	-0.478	-0.231
Proportion in Each Group, by Grade							
Poor	White	0.076	0.079	0.085	0.084	0.076	0.078
	Black	0.063	0.066	0.064	0.069	0.065	0.049
	Hispanic	0.024	0.023	0.031	0.027	0.019	0.021
Nonpoor	White	0.705	0.717	0.701	0.702	0.712	0.752
	Black	0.082	0.069	0.078	0.076	0.085	0.061
	Hispanic	0.050	0.045	0.042	0.043	0.042	0.039
Total Weight for Each Grade		2640.422	2350.790	2393.064	2263.253	2260.522	2639.59

NOTE: A blank space indicates only the at-grade-level math computation test was administered at grade 1.

Approximation of Standard Errors

Appendix A

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STANDARD ERRORS OF TABLE ENTRIES

Analysis of variance was applied to selected tables, and the highest-order interaction was used to estimate the error variance. A procedure based on these analyses is presented in Part 1 of this appendix. In Part 2, the derivation of the procedure is described.

PART 1. A Computational Procedure for Estimating Standard Errors

The standard error of the mean achievement for any given group may be estimated as

$$\sqrt{\frac{1.03}{pg}}$$

where p = the proportion in the given group for that grade

and g = the total weight for that grade.

For example, in Table 2.1, the mean on the vocabulary below-grade-level test for first graders whose mothers were not high school graduates is reported as -.580. At the end of Table 2.1, the proportion of first graders in this category is shown as .282, and the total weight for grade 1 is given as 2300.006. Entering these numbers into the formula,

$$\text{S.E.} = \sqrt{\frac{1.03}{.282 \times 2300.006}} = .040$$

Thus, a 68 percent confidence interval for the below-grade-level vocabulary mean for first grade children whose mothers are high school dropouts is $-.580 \pm .040$. The same standard error applies to the at-grade-level vocabulary test, the two reading comprehension tests, etc. To test the difference between the mean first-grade achievement for this group and for the second level of maternal education, the standard error of the difference between the means for these two groups may be computed as follows. First, the standard error for the high school graduate group is calculated:

$$\sqrt{\frac{1.03}{.606 \times 2300.006}} = .027$$

Then, the formula for the standard error of a difference is used:

$$SE_{1-2} = \sqrt{(SE_1)^2 + (SE_2)^2}$$

Entering the standard errors for the two groups,

$$SE_{1-2} = \sqrt{(.040)^2 + (.027)^2} = .048$$

A t test may now be calculated as the mean difference divided by its standard error:

$$t = \frac{.145 - (-.528)}{.048} = 14.02$$

The standard error estimate is based on more than thirty degrees of freedom, hence the normal approximation could be used to test the significance of this value. For a t statistic of this magnitude, however, a probability statement is clearly unnecessary.

The different groups at each grade level and across grade levels are distinct samples of pupils. Hence, standard errors computed in this way are appropriate for pairwise comparison across groups or grades.* The same pupils took the eight different tests, thus results for the same group on different tests are positively correlated. However, these positive correlations between tests signal smaller standard errors of the differences between tests than between groups. Therefore, a conservative procedure is to estimate the standard errors of differences between tests in the same way as those for group differences.

PART 2. Derivation of the Computational Procedures

Standard errors were estimated for specific tests in selected tables by the application of the analysis of variance procedure described below. Results showed no systematic differences across tests or tables, hence the same procedure may be used to estimate standard errors for figures

* The clustering and statification in the original sampling design are reflected in our estimation procedure.

for any of the tests in any table.

In each analysis a set of the relative means included in the report were used as data, each weighted according to the size of the sample on which it was based. Weighted estimation is necessary whenever the probabilities of sample selection were not uniform. Weights are constructed so that population subgroups which are under- or over-represented in the sample enter into estimates of population values in inverse ratio to their probability of selection. Thus, the proportion of the total weights (i.e., sum of individual weights) for pupils in any grade or subdivision is an estimate of the proportion of the total grade 1-6 public school population in that grade or subdivision. Total weights for each grade are given at the end of each table. (Due to the exclusion of missing data, totals vary somewhat from table to table.) Weights for subdivisions within a grade may be calculated as the product of the group proportion and the total weight for the grade. These weights were defined such that the total weight across all grades was equal to the numbers of pupils in the sample. I.e., the average weight across all pupils in the sample was 1.00. Details of sample design and weight construction are given in Sustaining Effects Study Technical Report numbers 1 and 2, by Hoepfner, Zagorski, and Wellisch (1977) and by Breglio, Hinckley, and Beal (1978, Appendix B).

The mean square corresponding to the highest order interaction in each analysis was taken as an (upper bound) estimate of the error variance. In a set of estimates formed in this way for the eight tests, using

Table 4.3, hours television by race by grade, the ratio of the largest error mean square to the smallest was 1.73, corresponding to a 32 percent variation in standard errors across the eight tests. Patterns of differences were not replicated across other tables, however, and a test for heterogeneity failed to reject the null hypothesis of equal error variances for the eight tests. The value 1.03 in the formula presented above was the median error mean square across all the analyses performed.